Solid State Processing and Integrated circuits Laboratory

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Purdue University

and

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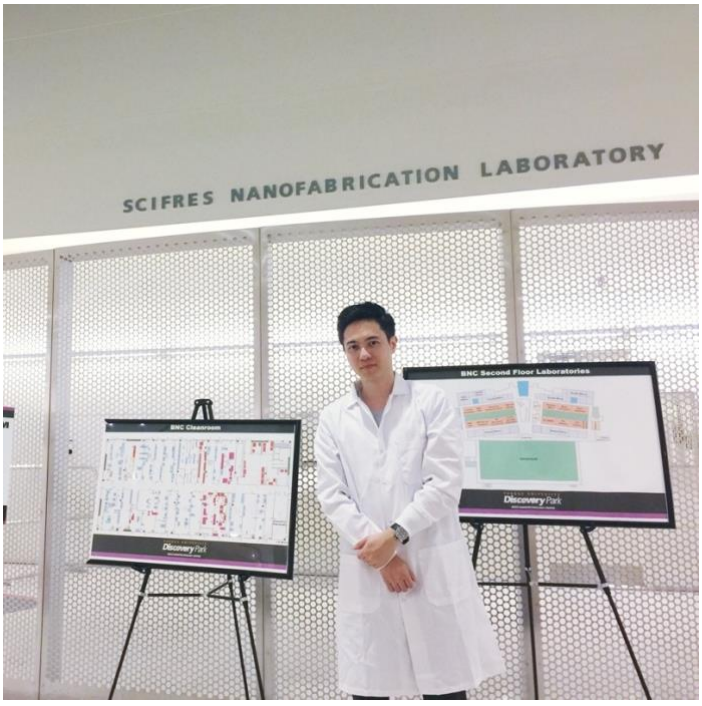
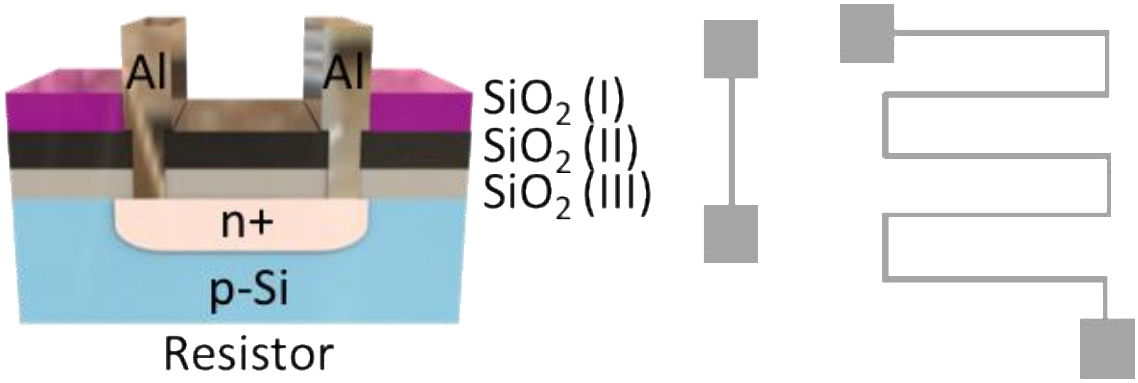
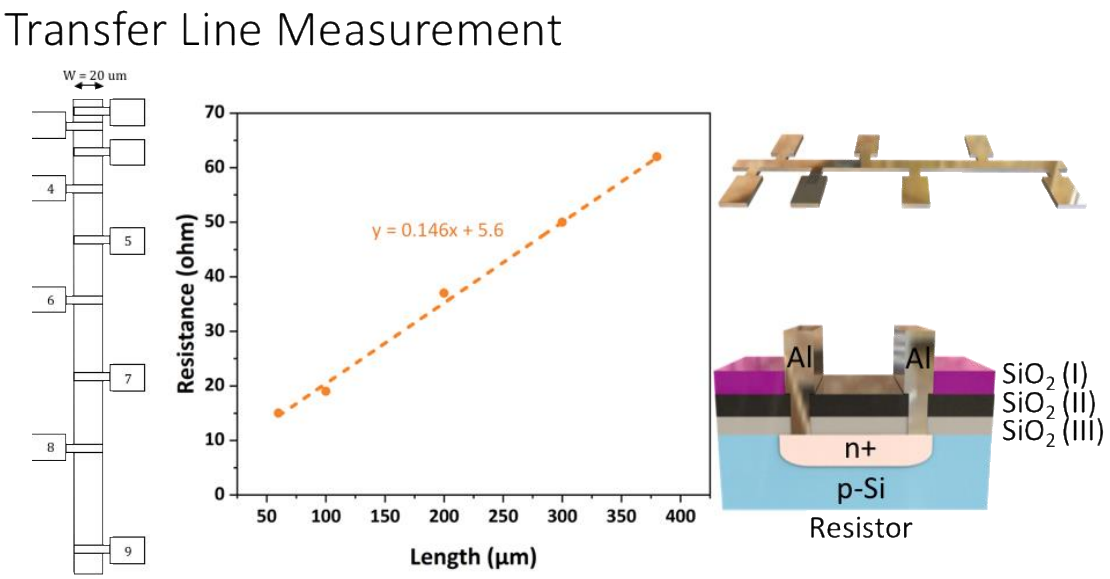
The following content is intended to highlight a small part of works that I have done for IC fabrication when I was at Purdue University and University of Southern California.



Resistors

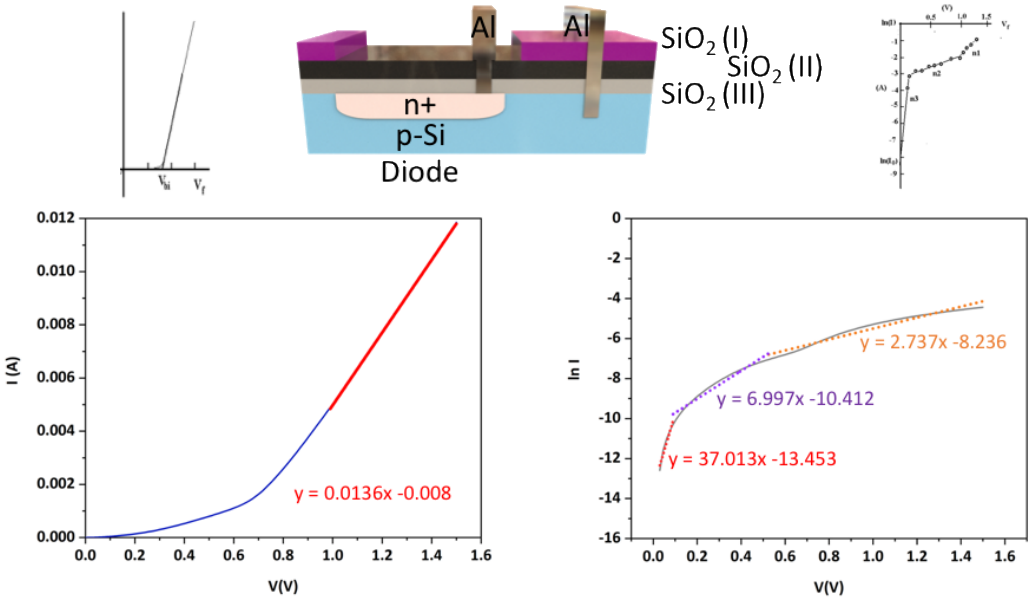
A resistor is a passive two-terminal electrical component that carry out electrical resistance as a circuit element. The resistor is used to protect the circuit by giving a certain amount of voltage in the integrated circuit. There are two most commonly used techniques in industrial environment to extract the sheet resistance of the resistors: Transmission Line Measurement and Transfer Line Method.





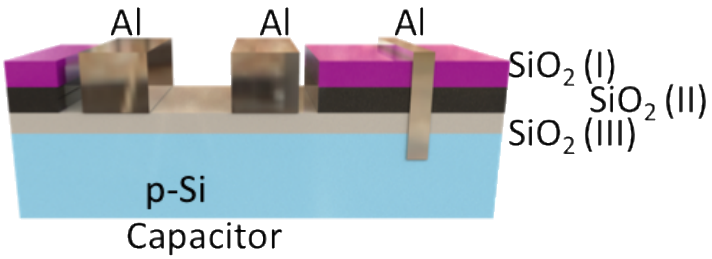
PN Diodes

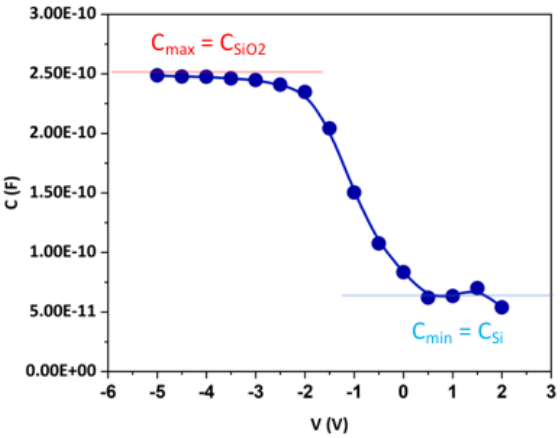
PN-diode has very simple structures compared with other transistors. A p–n diode is a type of semiconductor diode based on p–n junction. Diode is made by joining a p-type semiconducting layer to an n-type semiconducting layer. We are concerning about the I-V characteristic curves which can be measured a s follows.



MOS Capacitors

We must realize the concepts of MOS capacitors to understand how MOSFET works. The main use of capacitors is to store charge; An MOS capacitor is made of a semiconductor body, an insulator film, and a metal electrode called a gate. The oxide film can be as thin as 1.5 nm.





MOSFETs

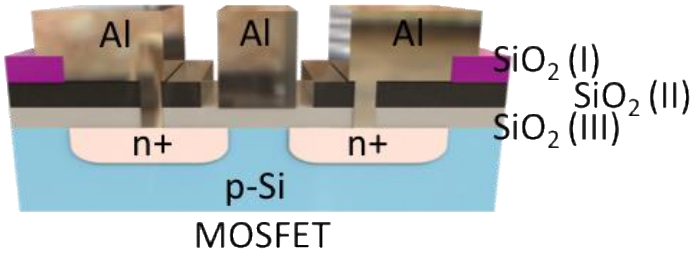
The metal–oxide–semiconductor field-effect transistor (MOSFET) is a transistor used for amplifying or switching electronic signals. The MOSFET is a four-terminal device with source (S), gate (G), drain (D), and body (B) terminals, the body (or substrate) of the MOSFET is often connected to the source terminal, making it a three-terminal device like other field-effect transistors. For the traditional MOSFETs, there are some assumptions used for the model With several conditions:

1) The channel length is long (L>5um)

2) Mobility of electrons is constant in the channel

3) The shape of channel is a linear function of drain-source bias

4) The electric field along the channel is the dominant electric field because it has a larger value compared to the electric field perpendicular to the channel.



MOSFET